(984.6 mb.) felt at 7:00 a. m. June 28. All of these values have been corrected for gravity.

Before this typhoon formed and during its progress, the few pilots received from Indochina and Thailand indicated that the southwest monsoon current was persistently strong, that is, with velocities over 50 km./hr. No reports are available from Netherlands East Indies, and these are necessary to show whether or not there was a southwesterly air stream of any strength moving toward the Western Caroline Islands before the storm center manifested itself by a fall of pressure at Guam and Yap, on June 23. The pilots at Guam showed that a mild surge from the east quadrant took place together with a shift to the southeast quadrant as the pressure began falling at Yap. Up to June 26, the upper winds over the Philippines were more from the northwest quadrant than from the southwest quadrant, Aparri excepted, where east quadrant winds predominated aloft. While the typhoon was over the ocean and moving westerly toward the northern part of Catanduanes Island, the reports from Indochina and Thailand, especially the two stations Saigon and Bandon, showed that the southwest monsoon current was very active. Not until the June 26 pilots from Zamboanga arrived was there any indication that the strong southwesterly current had crossed the China Sea to join the typhoon circulation. From this time on (i. e., after June 26), the center changed its course to the northwest and rainy and squally weather prevailed over the Philippines. The upper winds at Aparri changed somewhat to the northeast and north as the center approached northern Luzon, and shifted to the southeast on June 28, reporting velocities of 100 km./hr. and over when in this air stream. On June 30, when the typhoon center was near Hong Kong, the pilots from stations of northern Indochina clearly showed the different air streams connected with the typhoon and flowing over that locality, namely southwest quadrant winds below and north quadrant winds above.

RIVER STAGES AND FLOODS

By BENNETT SWENSON

Widespread precipitation, excessively heavy in some sections, resulted in considerable flooding during June 1941. Floods were particularly severe in portions of Kansas, Nebraska, Oklahoma and Texas, and in New Mexico during May and June. The floods in the Blue and Solomon Rivers in Kansas and Nebraska were the greatest of record. In the Trinity River the highest flood since 1908 occurred in the upper reaches between Dallas and Trinidad, Tex. Since the flooding continued at some of these points at the end of the month and inasmuch as complete reports are not yet available, a full discussion of the floods in the Missouri, Arkansas and Red River, and the west Gulf of Mexico drainage basins will be given in a later issue of the REVIEW.

The rainfall amounts during June were abnormally heavy generally in the Great Plains States from the Canadian border to the Rio Grande. Also in the Great Basin of the West the amounts were heavy, averaging as much as three times the normal precipitation.

East of the Mississippi River, where May was extremely dry, the rainfall during June was heavy in many areas. The New England States, New York, Michigan, Wisconsin, Tennessee, Alabama, and Mississippi had less than normal rainfall, but all other States had precipitation above normal; South Carolina had the wettest June in 35 years.

Atlantic Slope drainage.—River stages showed a rise during the month, but on the whole they were still unusually low at the end of the month. Flood stage was reached or slightly exceeded only at Rimini and Ferguson, S. C., in the Santee River, near the end of June.

Upper Mississippi River Basin.—No floods occurred in the main channel of the Mississippi except that flood stage was reached or slightly exceeded at Louisiana and Hannibal, Mo., during the month. Water levels were considerably above normal pool due to greater discharge from extended periods of rainfall.

Pronounced rises occurred in the smaller tributaries due to excessive thunderstorm rains. A flood occurred in the Root River Valley in extreme southeastern Minnesota on June 13 and 14. Some land was flooded and the damage was mainly agricultural. The only other tributary flooding reported was in the Rock River where the stage at Moline, Ill., was slightly above flood from June 4 to 6.

Missouri, Arkansas, and Red River Basins.—Extensive flooding occurred in most of the streams of Kansas, Nebraska, southwestern Iowa, northwestern Missouri, and in Oklahoma during June. In the Big Blue and Solomon Rivers in Kansas and Nebraska the highest stages of record were reached. A full report of these floods will be made in a later issue of the REVIEW.

Ohio River Basin.—The following report is made by the Official in Charge, Pittsburgh, Pa., in connection with floods in his district which comprises the Ohio River Basin at and above Wheeling, W. Va.:

The rivers in the Pittsburgh district were low during the last week in May, and the ground water considerably depleted. A showery condition set in on May 30, and continued almost daily until June 3, but there was not enough run-off from the rains to reach the rivers until the 3d, when the main rivers became stationary and slight rises occurred at scattered points, indicating that the ground had reached a fairly high percentage of saturation.

During the afternoon and night of the 3d, rains were heavy over the Monongahela Basin, and light to moderate over the Allegheny. These rains caused a rise of a few tenths of a foot in the Allegheny River, and from 7 to 11 feet in the Monongahela by 7 a.m. of the 4th. The upper Youghiogheny River rose 3.4 feet at Connellsville, Pa., and 4.8 feet at Confluence, Pa., by 7 a.m. of the 4th, and the Cheat River rose 3.9 feet at Rowlesburg, W. Va.

Heavy rains occurred again of the 4th, mostly in the afternoon extending over practically all of the district, but with the greatest concentration over the middle Monongahela Basin, where the heaviest rains had occurred on the 3d. The rains were unprecedented for several of the southwestern counties in Pennsylvania, and adjacent counties in West Virgina, being in excess of 6 inches for the 24 hours ending at 7 a.m. of the 5th. At Brownsville, Pa., Government lock No. 5, the precipitation on the morning of the 5th measured 6.27 inches. This heavy downpour quickly raised the tributaries in southwestern Pennsylvania and northern West Virgina to heights heretofore unknown. At the town of Brave, Green County, Pa., where Dunkard Creek normally is about 30 feet wide, and the bed of the creek about 15 feet lower than the general level of the ground, the water rose over the banks, and over the tops of automobiles on the highway. Inhabitants state that the crest of the rise came in about 30 minutes.

The water from these short tributaries quickly reached the Monongahela River at and below Greensboro, Pa., Lock No. 7, passing the flood stage of 30 feet by noon of the 4th and reaching a crest of 35.8 feet by 6 p.m.

The 7 p.m. reports on the 4th showed that the heavy rains were still in progress and the Monongahela and its tributaries still rising Forecast that stages at Pittsburgh would exceed the flood stage of 25 feet was first issued at 10 p. m. of the 4th. The forecast called for 25 to 26 feet by 2 p. m. of the 5th.

On the morning of the 5th, the rain had ended. The Allegheny River was rising slowly, the upper Monongahela was falling, and the Youghiogheny was falling at the headwaters, and about stationary in the lower river. On the basis of these conditions, a forecast was issued at 9 a. m., for 27.0 feet at Pittsburgh by 3 p. m. of the 5th, and 31.0 feet at Wheeling by 8 a.m. of the 6th. The forecast for Wheeling was again revised at 3 p. m. of the 5th, to between 33 and 34 feet by 8 a. m. of the 6th. The actual crest reached at Pittsburgh was 26.9 at 4:25 p. m. on the 5th. At Wheeling the crest was 33.8 feet at 9 a. m. of the 6th.

While the crest stages along the rivers were not unusually high, except at Brownsville, Pa. the damage was much greater than is usual for such stages, due to the swiftness of the Monongahela. The river men informed us that the Monongahela was never known to be so swift. The result was an unusually heavy loss to shipping interests.

Severe local flooding occurred in several of the smaller tributaries of the Ohio River between Wheeling and Huntington, W. Va., early in June. Fish Creek, Fishing Creek, and Middle Island Creek, southern tributaries of the Ohio in West Virginia, had the highest stages since 1913. Among the northern tributaries affected were Hocking River and Racoon Creek. The latter stream enters the Ohio River just below Point Pleasant, Ohio. The Weather Bureau maintains service only on the Hocking River and the crest in that river reached Athens, Ohio, on June 5 at a stage of 18.95 feet.

A period of occasional heavy rains over the watershed of the White River in Indiana resulted in a substantial rise in that river which had been at unusually low stages. Flood stage was exceeded only at Edwardsport, Ind., on the West Fork, where a stage of 13.4 was reached on June 12.

Stream flow increased somewhat during mid-June in the Tennessee River, but again approached critically low levels at the close of the month.

West Gulf of Mexico drainage.—In the reach of the Trinity River from Dallas to Trinidad, Tex., the highest stages since 1908 were experienced during the month. The Rio Grande and the Pecos Rivers which were in high flood during May continued to flood during much of June. A report of these floods will be given in a later issue of the REVIEW.

Pacific Slope drainage.—The seasonal peak of the run-off in King's River was reached on June 6 when a crest of 11.25 feet occurred at Piedra, Calif. The stage at Piedra was also above flood stage (10 feet) in two periods later in the month. The discharge remained above average to the end of the month and a small excess was entering Tulare Lake Basin where additional flooding caused by breaking levees occurred during June.

Estimated flood losses and savings for June 1941.

River and drainage	Tangible property	Matured crops	Prospective crops	Livestock and other movable farm property	Suspension of business	Total losses	Total savings
Upper Mississippi Basin							
Root River (Minnesota)		$2,000				$2,000	
Missouri River Basin							
Solomon River	$9,500	161,000	$44,000	$7,450	$5,500	227,450	$30,000
Saline-Smoky Hill River	21,000	102,000	55,000	12,000	2,500	192,500	40,000
Republican River	792,180		[1] 1,203,380	14,700	91,300	2,101,560	[2]
Big Blue River	784,500	375,000	359,120	58,000	60,000	1,636,620	200,000
Kansas River	61,250	122,500	92,000		20,400	296,150	107,500
Grand River (Missouri)			30,000			30,000	3,000
Osage River (Kansas)	5,500	11,000	13,500	5,000		35,000	1,000
Missouri River	330,225	275,500	1,443,500	27,900	13,900	2,091,025	197,500
Ohio River Basin							
Allegheny River	20,000					20,000	25,000
Monongahela River	730,000		100,000			830,000	1,000,000
Ohio River	40,000		5,000			45,000	50,000
Arkansas River Basin							
Verdigris and Cimarron Rivers [3]	4,500	40,000	80,000		30,000	154,500	250,000
Neosho River	127,000	485,000	229,000	500	19,000	860,500	399,000
North Canadian River [4]	102,500	4,000	122,000	6,500	5,300	240,300	18,500
Canadian River [4]	158,300	118,500	53,800	23,700	8,300	362,600	14,000
Arkansas River [5]	6,300	55,000	115,000	100	20,000	196,400	221,600
Red River Basin							
Washita River	355,150		969,675			1,324,825	
Red River [4]	19,000					19,000	
West Gulf of Mexico Drainage							
Hubbard Creek (Albany, Tex.)	106,000					106,000	
Rio Grande (lower)	20,500	50,000	75,000	75	20,000	165,575	23,000
Pecos River	65,000	90,000	175,000			330,000	

[1] Includes also matured crops.
[2] Not reported.
[3] Including part of Arkansas River above Fort Smith, Ark.
[4] Losses in May.
[5] Below Fort Smith, Ark.

FLOOD LOSSES AND SAVINGS

Available figures on estimated flood losses and savings during the month of June are given in the table below. Some figures for the past month which were not available in time for inclusion in the May REVIEW are also given here.

FLOOD-STAGE REPORT FOR JUNE 1941

[All dates in June unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
Santee:	*Feet*			*Feet*	
Rimini, S. C.	12	28	30	12.4	29
Ferguson, S. C.	12	29	(1)	12.1	30
Savannah: Clyo, Ga.	11	30	(1)		
MISSISSIPPI SYSTEM					
Upper Mississippi Basin					
Rock: Moline, Ill.	10	4	6	10.3	5
Mississippi:					
Hannibal, Mo.	13	11	12	13.0	11–12
Louisiana, Mo. [4]	12	(2)	(2)	12.4	6
Missouri Basin					
Solomon:		8	14	35.9	11
Beloit, Kans.	18	25	25	18.2	25
		28	(1)		
Niles, Kans.	24	14	19	29.1	17
Saline: Tescott, Kans.	25	12		29.2	15
Smoky Hill:					
Lindsborg, Kans.	21	12	14	24.5	13
Salina, Kans.	20	14	16	20.9	15
Enterprise, Kans.	26	18	20	27.4	19
Republican:		3	4	9.6	4
Guide Rock, Nebr.	9	8	13	12.2	10
Scandia, Kans.	10	8	13	13.4	9
Concordia, Kans.	8	8	14	11.8	9
Clay Center, Kans.	15	9	14	20.9	10
Junction City, Kans.	10	10	14	14.7	11
Little Blue:					
Endicott, Nebr.	11	8	11	16.2	9
Hanover, Kans.	14	9	12	[4] 25.0	10
Big Blue:					
Beatrice, Nebr.	16	8	10	22.15	9
Barnston, Nebr.	18	8	11	33.0	9
Hull, Kans.	22			34.3	
Blue Rapids, Kans.	20	9	13	39.5	10
Randolph, Kans.	22	10	13	30.8	10
Kansas:					
Ogden, Kans.	18	11	14	20.7	12
Manhattan, Kans.	17	10	15	23.5	11
Wamego, Kans.	16	10	14	21.9	11
Topeka, Kans.	21	11	14	25.8	12
Lecompton, Kans.	17	11	14	21.0	13
Lawrence, Kans.	18	12	14	20.3	13
Bonner Springs, Kans.		12	15	[4] 22.3	13
Grand:					
Gallatin, Mo.	20	9	12	27.4	11
Chillicothe, Mo.	18	3	4	21.0	3
		9	13	28.3	11
Brunswick, Mo.	12	10	20	18.1	15
Osage:					
Quenemo, Kans.	30	2	2	31.2	2
LaCygne, Kans.	25	12	12	25.0	12
Missouri:					
Blair, Nebr.	18	17	19	18.6	18
Nebraska City, Nebr.	15	15	21	17.1	20
Kansas City, Mo.	22	11	15	24.7	13
Waverly, Mo.	18	11	18	20.9	15
Boonville, Mo.	21	15	18	22.4	17
St. Charles, Mo.	25	15	21	26.9	19

See footnotes at end of table.